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Determinacy, learnability, and discretionary policy

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Abstract

Within a monetary sticky-price model, this paper shows that the optimal discretionary policy, which looks a lot like the Taylor rule, brings about determinacy and least-squares learnability of rational expectations equilibria if and only if it satisfies the long-run version of the Taylor principle.

Keywords: Determinacy; Least-squares learnability; E-stability; Discretionary policy; Taylor rule

JEL classification: E52

1. Introduction

A considerable amount of recent research on monetary policy has examined whether a proposed policy brings about determinacy and learnability of equilibrium in rational expectations models.[1] The learnability or E-stability of rational expectations equilibria (REE), a concept emphasized recently by Evans and Honkapohja (1999, 2001), asks whether, for small expectation errors, a proposed policy can lead temporary equilibria under such non-rational expectations to adjust over time toward the associated REE. As for discretionary policy, Evans and Honkapohja (2003), using a simple sticky-price dynamic

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[1] See, e.g., Bullard and Mitra (2002), Carlstrom and Fuerst (2004), and Kurozumi (2004).

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general equilibrium model that has been standard in recent monetary policy analyses,[2] show that the expectations-based optimal policies yield a determinate, least-squares learnable REE; while the fundamentals-based optimal policies, including those based on the current inflation rate and output gap,[3] have problems with indeterminacy or E-instability of REE.

This paper employs a money-in-utility-function model with sticky prices, which is studied by Woodford (2003; Sec. 4.3, 6.4), to examine under what condition optimal discretionary policy leads to determinacy and learnability of REE. In contrast to the standard but less general model used in Evans and Honkapohja (2003), the interest-rate stabilization is one of the welfare-based policy objectives in the model here.[4] This in turn yields the optimal discretionary policy that looks a lot like Taylor's (1993) rule. This paper shows: (I) this optimal policy generates a determinate, least-squares learnable REE if and only if it satisfies the long-run version of the Taylor principle: in the long run the nominal interest rate should be raised more than the increase in inflation; (II) this principle is satisfied if (i) the elasticity of substitution between goods is sufficiently large, (ii) the output elasticity of real marginal cost is sufficiently large, or (iii) the interest-rate semielasticity of money demand is sufficiently small.

2. Optimal discretionary policy in a monetary sticky-price model

From a money-in-utility-function model with monopolistically competitive firms' staggered pricing à la Calvo (1983), Woodford (2003; Sec. 4.3, 6.4) derives IS Eq. (1) and AS Eq. (2), which represent private sector behavior, together with welfare-based policy objective function (Eq. (3)):

$$\left(1-\sigma\eta_y\chi\right)x_t=\left(1-\sigma\eta_y\chi\right)\hat{E}_t x_{t+1}-\sigma\left(i_t-\hat{E}_t\pi_{t+1}-r_t^n\right)+\sigma\eta_i\chi\left(\hat{E}_t i_{t+1}-i_t\right), \tag{1}$$

$$\pi_t=\beta\hat{E}_t\pi_{t+1}+\kappa x_t+\kappa_i i_t, \tag{2}$$

$$\hat{E}_0\sum_{t=0}^{\infty}\beta^t\left(\pi_t^2+\lambda_x x_t^2+\lambda_i i_t^2\right), \tag{3}$$

where x_t is the output gap, π_t is the inflation rate, i_t is the nominal interest rate, r_t^{n} is an exogenous disturbance representing the natural rate of interest, and $\hat{E}_t$ is the possibly non-rational expectations operator conditional on information available at time t. In Eq. (1), $\sigma>0$ is the intertemporal elasticity of substitution in consumption, η_y, $\eta_i>0$ measure the output elasticity and interest-rate semielasticity of money demand, and χ represents the degree of non-separability of the utility function between consumption and real balances.[5] In Eq. (2), $\beta\in(0,1)$ is a discount factor, $\kappa\equiv\tilde{\kappa}(\omega+\sigma^{-1}-\eta_y\chi)$, and $\kappa_i\equiv\tilde{\kappa}\eta_i\chi$ where $\tilde{\kappa}>0$ denotes the frequency of price adjustment and $\omega>0$ measures the output elasticity of real marginal cost. In Eq. (3), $\lambda_x\equiv\kappa/\theta$ and $\lambda_i\equiv\tilde{\kappa}\eta_i/(\theta v)>0$ where $\theta>1$ is the elasticity of substitution

[2] See Clarida et al. (1999), McCallum and Nelson (1999), Woodford (2003, Sec. 4.1), among others.

[3] See Section 4.3.3 in Evans and Honkapohja (2003).

[4] Duffy (2003) and Duffy and Xiao (2004) use the standard model with the interest-rate stabilization policy-objective to numerically investigate whether optimal discretionary policy brings about determinacy and E-stability of REE.

[5] If the utility function is separable (i.e. $\chi=0$), Eqs. (1) and (2) take the same forms as IS and AS equations in the standard model used in Evans and Honkapohja (2003), Duffy (2003), and Duffy and Xiao (2004).